THIGH-LAGER WITH KUNTSCHER'S NAILING IN THE MANAGEMENT FRACTURE SHAFT FEMUR

THESIS

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C E R T I F I C A T E

This is to certify that the work entitled, "THIGH LACER WITH KUNTSCHER'S NAILING IN THE MANAGEMENT OF FRACTURE SHAFT FEMUR", which is being submitted as a thesis for M.S.(Orthopaedics) examination, 1991 of Bundelkhand University, by MURARI LAL, has been carried out under my direct supervision and guidance. The techniques embodied in the thesis were undertaken by the candidate himself and observations recorded have been checked by me.

He has put in the necessary stay in the Department of Orthopaedics, according to University regulations.

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C O N T E N T S

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INTRODUCTION

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In modern era of high speed traffic and every days increasing vehicular traffic congustion on roads, there is increase in number of accidents which leads to various types of simple and compound fractures. The diagnosis of fractures demand a greater amount of ready knowledge, self reliance and consummate skill. Management of fracture requires more through knowledge of topographical anatomy, a nicer sense of discrimition, a calmer judgement, more enlarged experience or a greater share of vigilance and attention.

Among the long bones, femur is one of the commonest to undergo fracture during accident. There may be simple or compound fracture of proximal, middle and distal third of femoral shaft, with or without comminution. Fractures may be transverse, oblique or spiral.

As the femur is surrounded by groups of muscle so the close reduction of femur is very difficult. Before introduction of internal fixation, femoral shaft fracture were treated by traction until fracture united. The main problem of this conservative treatment are joint stiffness,

muscle wating, osteoporosis, prolonged hospitalization, thromboembolic phenomenon and above all psychic disturbance.

As Murray has described, "To wish the fracture fragments into place, hold them there by moral suasion and send the patient on about his business while the fracture heals". Though the ideal fracture treatment is as described by Murray, but it is not possible practically. Various attempts were being made by different persons in last 50 years to reach nearest to this ideology.

Intramedullary nailing of femoral shaft fracture first introduced by Hey Groves in 1918 and later popularised by Kuntscher in 1940. Kuntscher did the closed intramedullary nailing in femoral shaft fracture during second world war to facilitate the transport of patient from one place to another place without any difficulty.

After 1939, the operative technique have been refined and the method is now widely used, however the results are not uniformly excellent. In recent years various other method of internal fixation like plate osteosynthesis (Margerl et al, 1979; Muller et al, 1979). Ender nailing (Pankowich et al, 1979), Sampson rod (Mc-Master et al, 1980) are in practice. So now there is wide range of treatment for fracture shaft femur for which

one has to select the treatment applicable to circumstances and specific institutional situations.

The patients of fracture shaft femur treated either by traction or by open reduction and internal fixation are not permitted to bear weight until there is union of fracture clinically as well as radiologically. This lead to prolonged bed-ridden, away from the job, leading to economic problems in addition to other problems like muscle wasting, joint stiffness, osteoporosis and prolonged hospitalization. To overcome this problem, in the recent years, there is concept of functional bracing came in practice.

Initially John Hunter (1791) when confronted with different fractures of proximal femur, instructed the patient "to walk upon crutches and to press as much as on broken thigh as the state of part would admit" the fracture went on to unite.

Delbet (1916) reported success in treating fracture with ischial weight bearing orthotic device. Their initial brace was made of viltrathene and plastazone. In recent years the pioneer work of Sarmiento (1967) has brought the concept of functional bracing in management of long bones fractures. In 1970, Mooney et al reported success with use of hinged plaster cast in treatment of

fracture of lower end femur. Lesin (1977), Cortwell (1978) and Maini et al (1985) and Bhalla used plastic thigh lacer instead of plaster cast brace.

The brace provides support for the fracture site and lessens the load of skeletal system by converting the thigh into semi-rigid hydraulic tube. On the other hand, walking in brace provides uniform intermittent compressive pressure which promotes osteogenesis. This is how it provides physiological stimulus to bone and soft tissue which hasten the healing process.

The recent interest in functional bracing is undoubtedly a reflection of economies of medical care. Now-a-days, the most expensive items in patient care is the cost of hospitalization. The focus of attention now is to reduce the amount of time spent in hospital without reducing standard of care. Undoubtedly time spent in hospital after fracture of femur is least if the fracture is internally fixed and is followed by functional bracing.

Functional brace made up of various material can be applied after conservative treatment, i.e. traction or after open reduction and intramedullary Kuntscher nailing. In conservative treatment initial traction of about 4-6 weeks is given then functional brace is applied while after operative fixation by Kuntscher nail, functional brace can be given after removal of stitches.

If the favourable feature of rigid fixation and functional brace are amalgamaged, a fruitful symbiosis will result so in our present study there is fixation of fracture shaft femur by Kuntscher intramedullary nailing with functional thigh lacer made up of low density polythene 3 mm sheet and moulded individually for each patient. After application of thigh lacer, the patients were encouraged to do active and passive motion exercise for hip, knee and ankles and were encouraged to walk gradually with help of crutches.

AIMS OF FUNCTIONAL THIGH LACER

1. Restoration of function of injured limb, at earliest.
2. Preservation of hip and knee joint movements with early recovery of thigh muscle power.
3. Moderate expenditure of time and money and brief hospitalization.
4. To achieve early ambulation and early union.

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REVIEW OF LITERATURE

REVIEW OF LITERATURE

The principles in the treatment of fractures namely, reduction and adequate immobilization until the fracture is healed, have evolved since the early medical writings of Greece, Egypt and India.

Intramedullary nailing of femoral shaft fracture, first introduced by Hey Groves in 1918 and later popularised by Kuntscher (1940, 1958, 1967), Bohler (1951), Street (1951) and Lottes (1953). Nicholas (1963), reviewed the results of rehabilitation after femoral shaft fractures, also reported better end-result after intramedullary nailing than after any other method of treatment.

During world war II, Kuntscher's introduction of the technique of intramedullary nailing for fixation of the femoral shaft and early ambulation was perhaps the first serious attempts at putting these principles to the test.

The consensus of the study reported in a Symposium in 1951, says "It is obvious that in proper hands medullary nailing of the femur is a worthwhile procedure and that the complication, while frequent, are not sufficiently grave to prohibit the use of this method

by those who are skilled in bone surgery and who can work under proper conditions. On the other hand, the operation is serious one and it may be difficult procedure and should not be taken lightly. It is especially advised that the instruments necessary for inserting, withdrawing and cutting the nail be available and that the proper size and length of the nail should be selected before hand and should be on hand before the operation is started. In this way the operating time will be lessened and many of the difficulties will be eliminated".

The nail should firmly grip the inner cortices of the medullary canal both above and below the fractures in order to achieve stability which is the aim of the operation. Thus the technique is limited to the fractures located more than 2 inches distal to the lesser trochanter and more than 7 inches proximal to the adductor tubercle.

The medullary fixation is suitable for any patient over the age of puberty and under the age of senility and debility. The fracture with moderate or severe comminution even in the area ideally suited for medullary nail, skeletal traction followed by cast immobilization is now the treatment of choice.

O'Brien reported "more trouble than with any other method" especially when the standards set by Kuntscher for intramedullary nailing of the femur were not met". Dencher reported a 14 percent technical error with medullary nailing used in series of 435 cases of fracture of femoral shaft, one fifth of which give rise serious complication. Wickstrom and Corban discovered a 3 percent of deep and superficial infections and 4.3 percent incidence of delayed or non-union in 295 cases. Belder reported deleterious effect on knee occurring as late as five years after the surgery. Wickstrom, Corban reported a 1.5 percent incidence of major vascular complication with open surgery of these fractures.

Perusal of the literature reveals however, some dissatisfaction with the method. The technical performance of the operation is far from uniform and obviously it often fall far short of the standard demanded by Kuntscher. Chronic ostitis delayed union and non-union are sequelae frequently reported after intramedullary nailing (Lauritzen, 1949; Palmer, 1951; Charnley and Guindy, 1961; O'Brien, 1963; Dencker, 1965), reviewing the result of different methods of treatment of femoral shaft fracture in Swedish hospital from 1952 to 1954, concluded that although many of the nailed fractures did quite well, the rate of complications was so high that conservative treatment with traction should still be given preference in routine work.

In all reports sepsis after intramedullary nailing by open technique appears to be greatest drawback. Dencker in 588 fractures of the femoral shaft treated with open methods, noted a 6 percent infection rate; Wilson, Mac Ausland and Eaton have reported encouraging result in the treatment of the complication after establishment of adequate drainage and administration of intravenous antibiotics until the infection is controlled, maintaining rigid intramedullary immobilization until solid union occurs.

A review of 50 femoral shaft fractures treated by open reduction and fixation by Kuntscher clover leaf nail at Campbell Clinic from 1957 to 1967 has been made. The period of observation after surgery ranged from 6 months in one patient to 10 years in 2 patients, an average of 30 months. The age of patient varied from 14 to 85 years. The series included 34 recent fractures, 6 pathological fractures and 10 non-union. Forty eight fractures were close and 10 were open. Among the 50 patients, there were only 2 major complications. One patient died of a pulmonary embolism 15 days after surgery. The other patient developed overwhelming infection which required mid thigh amputation.

They have preferred the clover leaf Kuntscher nail to solid type of nail for three reasons. (1) It is more economical to have in stock nails of one standard

length in variety of diameters. The nail can be cut to proper length. (2) Hollow nail allows more ingrowth of the tissue for healing than does solid nail. (3) The compressibility of this nail probably provides a tighter fit over a longer period than does the solid nail.

Recent refinements in surgical technique have materially altered intramedullary nailing. The development of image intensifiers have revived interest in closed nailing. Both Kuntscher (1959) and Bohler (1965) reported encouraging report with such a technique. It stated that infection and non-union were eliminated, a claim fully supported by Grass and Giebink in twenty one cases, but only partially supported by other workers. Boher noted a 1.76% infection rate in 308 closed intramedullary nailing procedures in contrast to 4 percent with open nailing technique. Rockanen Slatis and Vaukka, although preferred closed technique, did not find any significant difference in rate of complication with either open or closed intramedullary nailing.

Medullary nailing of fracture of the proximal two-third of the femoral shaft is now established as a satisfactory means of treatment (Muller et al, 1965). Attempts have been made to overcome the instability due to torque by supplimentation of the intramedullary nail by external plates (Funk et al, 1968; Burwell, 1971).

Huckstep and his colleagues (1972) have designed a solid medullary nail which has holes at every 15 mm along its length. Following insertion of the nail the proximal and distal fragments are held rigidly in place by screw which pass into the tapped holes in the medullary nail. While external plate and the Huckstep nail certainly overcome the instability due to torque, they have disadvantage that to remove them requires re-exploration of the fracture site which converts the minor procedure of Kuntscher nail extraction into one of greater severity.

Another technique, plate fixation of femoral shaft has also received a great deal of attention in past 10 years. Mann and Sarmiento have recommended that this form of fixation to be used in fresh long oblique, spiral fractures of the femoral shaft only. Gant, Shaftan and Herbsman (1970) in report of experience with the ASIF technique in the treatment of fourteen closed femoral fracture described three cases of double plate breakage and fracture angulation. They therefore recommended that the technique be used only in co-operative patients whose femoral shaft fracture could not be handled otherwise.

In marked contrast to open method of treatment the reports on closed traction treatment have been far more favourable. Martin and Mc-Goey (1961) suggested that traction was well tolerated in younger patients and

recommended it as the method of choice. Bencher, in a comparison of the result of various treatment in 1003 cases found that the incidence of non-union with open method of treatment was 8 percent and that all seven deaths in series occured with open method of treatment. He concluded that skeletal traction should be standard method of treatment for both closed and open fractures of femoral shaft, regardless of patient's age, the type of fracture and level of fracture unless special circumstances dictated the use of another technique.

Anderson in the study of thirty nine femoral shaft fracture in children and fifty nine in adults treated conservatively in most cases by Russell traction, reported very low and insignificant complication rate, however, he was dissatisfied with the longer hospitalization time, slow ambulation and some time inadequate reduction obtained with this method.

These reports indicate clearly that although open method of fixation has generally led to more perfect alignment of the fractures, the complication rate has been significant, whereas prolonged immobility and joint stiffness were all too common with conservative skeletal traction technique.

The plaster cast brace for use in the ambulatory treatment of fracture of the shaft of the femur was

introduced by Mooney and his colleagues in 1970. The femoral cast brace offers a new dimension to the treatment of femoral shaft fractures. Such fractures have been treated previously by either traction and spica cast or open reduction and internal fixation. The standard non-operative management is time consuming and expensive. Open reduction and internal fixation although generally reliable and less costly does surprise the surgeon and patient with a rare tragedy. The cast brace is particularly appropriate for treatment of the "floating knee", a rheumatoid arthritic knee, patient with mental confusion, severe cardio-pulmonary problems (to get patients up from position in traction), present or previous infection of the femur. The femoral cast brace shortens the hospital stay, in comparison to traction method and avoid complication of open reduction and internal fixation. Weight bearing encouraged soft tissue healing as well as bony union.

Initially John Hunter (1791) when confronted with difficult fracture of the proximal femur instructed the patient "to walk upon crutches and to press as much as on broken thigh as the state of part would admit". The fracture went to unite.

The first brace specifically designed for fracture cases was reported by Smith (1855). This device, which had a waist band, an ischial support and thigh lacer, was to be used for ununited fracture of femur. Smith called the

device a prosthesis, and as the term implies, he believed that the device would substitute for fractured limb. He believed that containment of thigh musculature in laced cuff helped to maintain fracture alignment and much of his surprise, all seven fractures so treated healed.

Delbet (1916) of France reported success in treating femoral fractures with an ischial weight bearing orthotic device.

Mooney et al (1970) reported a 2 years controlled experience with use of cast brace for fractures of the femur. After a mean traction time of 7.3 weeks, the fractured extremity was placed in cast brace and weight bearing ambulation allowed and encouraged. All the fractures healed after a mean immobilization of 7.2 weeks, giving a mean total treatment time of 14.5 weeks and for those treated in traction followed by spica immobilization the mean treatment time of 24.7 weeks.

Mooney et al (1970) described an adjustable plastic thigh section and knee joint for femoral fracture. The term cast brace is used to describe a device that provides circumferential support to a segment of a fractured limb while allowing mobility of nearby joints and thus early functional ambulation.

Adjustable plastic thigh components have the following advantage.

1. Total contact is always available because the straps and flexible brim can be tightened when atrophy occurs, thereby saving cast changes.

2. There is no need to use a separate brim which must be incorporated in the cast.

3. The orthosis is lighter than the earlier type, can tolerate draining wounds and make wound dressings easier.

4. No alignment tool is needed.

5. No shaping of joints is needed. Flexibility of the plastic joints allows them to fit flush on the cast without use of bending irons.

6. Varus and valgus adjustments can be made. Extra holes on the thigh section where the joints attached allow angular and A.P. adjustments simply by removal of two or four screws.

Kaufer (1972) did the study in management of fracture shaft femur by initial traction and later on by post-traction cast or braces in order to avoid the hazards of operative therapy and to reduce the period of hospitalization. He selected 60 patients of fracture shaft femur with transverse, oblique, comminuted, segmental and compound fractures. Initially all the patients were kept

on skeletal traction with average period 22.8 days (range 11 - 42 days). Then cast was applied extending from submammary region to supramalleolar region. The foot and ankle was left free. The sound lower extremity was entirely free. Ambulation was then started with full weight bearing prior to discharge. The time between cast application and discharge was 6 days. Total duration of hospitalization was an average of 29 days (range 14 - 45 days). The patients started full weight bearing without external support in an average of 175 days (range 188 - 360 days). In majority of cases the results were satisfactory but there were angular deformity, shortening, plaster sores, non-union in few cases.

Joseph Moll (1973) reported on the use of the cast at Brooke Army Hospital in 178 patients with 184 (6 bilateral) femoral fractures. Most of these fractures were open combat injuries due to fragment or gun shot missiles. Only three fractures failed to unite and four of the open fractures required further surgical procedures following initial debridement and delayed closure. Initial reduction was achieved by skeletal traction followed with application of cast brace as soon as the reaction to the injury subsided. Average healing time was 7.5 months for open fractures and 5.5 months for closed fractures with 15 cases of malunion and three cases of non-union and 15 cases of unsatisfactory knee motion.

Connolly et al (1973) reported a quantitative analysis of efficiency of immobilization in skeletal traction and cast brace using the technique of electro-geniometry and cinero-entgenography. They found in a limited number of patients that rotation at the fracture site while the patients was in bed, was less than when wearing a cast brace. Movements of bone fragments during weight bearing in the cast brace was minimal in supra-condylar, intercondylar and mid shaft comminuted fractures but considerable in mid shaft transverse fracture. A follow-up evaluation of 143 fractures shaft femur treated by closed reduction, early application of cast brace and ambulation. The incidence of non-union and malunion was 0.7 percent, of shortening of more than two centimeters 13%, of symptomatic loss of knee motion 5.4%, of refracture 2 percent and pulmonary emboli 3 percent.

Schweigel and Groper (1974) did the comparative study of ambulatory versus non-ambulatory care of femoral shaft fracture. They compared 37 patients treated with a cast brace and an unselected group of 40 patients with fractured femoral shaft. Both these groups were treated by skeletal traction followed by cast brace or single hip spica. The cast brace consists of a quadrilateral socket. Two side bars with an attached heal and a drop lock at knee. The duration of treatment was much less in the cast brace group. This group averaged 41 days (6 weeks) less time in

traction and 66 days (9.5 weeks) less time in hospital stay, compared to spica group. The cast brace group averaged 85 degree range of motion at the end of treatment time compared to 35 degree in the spica group and commenced ambulation 8 weeks earlier than the latter group. The spica group had four non-union, one delayed union and two refractures. None of these complications were seen in cast brace group of patients.

Mittal and Bonadio (1974) worked with cast brace from 1968 to 1970 over 150 patients with various types of fractures. In all the patients with fresh fracture of femur, tibial skeletal traction was used initially to obtain satisfactory position. They preferred to apply the cast brace 3 to 6 weeks after injury when the fracture site was no longer tender, the swelling had subsided and open wound, if any, had healed. Mean time of application of cast brace was 6.4 weeks. After application of cast brace, knee joint motion was instituted and ambulation and weight bearing were started after the cast brace was consolidated and dried completely, with axillary crutches. On an average, full extension to 90 degree flexion was achieved within 8 - 10 days. Eight weeks was average time, the cast brace was required to wear with range of 5 to 35 weeks. Radiological evidence of union and absence of any clinical discomfort at fracture site were criteria for discontinuing the external support. In follow up, at least for three

months after removal of brace, in no case was there any deterioration in healing and alignment of fractures.

Andrews (1976) supported the use of cast bracing instead of traction and hip spica or open reduction and internal fixation under certain circumstances. These conditions are :

1. The fractures that are poorly suited structurally for open reduction and intramedullary nailing.
2. The poor condition of the patient for operation.
3. The need to move the patient to sitting position.
4. The obvious advantage of shorter hospital stay than with traction.
5. Particular condition suited to the cast brace such as floating knee.

Time of casting in 34 patients with no other complications was 27 days. Hospital stay averaged above five weeks (35.5 days). Average time in plaster for 17 uncomplicated cases was 3.9 months. Average shortening of the leg was 0.4 inches. No patient had greater than 1 inch of shortening. No gross malunion occurred. Knee motion except in previously injured limb, was excellent.

Adair (1976) in order to relieve the pressure on an over-worked fracture service, the early mobilization

of patients with fractures of femoral shaft in plaster cast was investigated. The cast is designed to have a weight relieving function and to mould the soft tissue of the thigh around the fracture. Using this method, 40 patients were discharged from hospital in an average of 44 days from injury and all these fractures healed rapidly and successfully.

Pearson (1977) studied 100 cases of closed fracture of the femur admitted to a Nigerian hospital during the year 1954-71 and treated by skin and skeletal traction, the mean time to clinical union was 6 weeks and discharge on protected weight-bearing for 7 weeks. There was no cases of non-union.

Wardlaw (1977) treated ninty eight fractures of shaft of femur over two years 1974 and 1975 and results have been assessed in 69. Of these, 38 were treated by skeletal traction in Thomas Splint and 31 by skeletal traction followed by cast brace. He divided fractures into three groups according to their treatment.

Group I : Traction alone

Group II : Traction and cast bracing.

Group III : Internal fixation.

There were two cases of delayed union both in group II. One fracture took 40 weeks to unite while in other Kuntscher nailing and bone grafting result was

excellent in one year. There were two cases of non-union in each group. Swelling of the knee joint may occur in patients treated by a cast brace. Increased angulation occurred after application of cast brace in 7 patients. The angulation was 5 degree in 4 and 15 degree in 2 cases.

The stay in hospital was 15 weeks average (9-30 weeks) in group I and in group II, 8 weeks average (2-18 weeks). It is concluded that when used with all the judgement and skill it demands, the cast brace method is great advance in conservative treatment.

Lesin, Mooney (1977) over a 6 months period, 23 consecutive patients with 26 femoral fractures that were not considered appropriate for internal fixation were treated by cast bracing. All the patients in this series were treated initially with skeletal traction applied under local anaesthesia. Once the patient's clinical state had stabilized then cast brace was applied. All fractures were followed for at least 9 months. The interval between injury and application of cast brace ranged from 2 to 33 days. The period of hospitalization after cast bracing ranged from 47 to 205 days. In 8 cases, the shortening ranged from 1 mm to 10 mm and in 6 cases from 11 to 15 millimeters. One patient had 20 millimeters shortening. The range of knee movement was 135 degree of flexion or more in majority of the patient. Only in one un-cooperative patient non-union occurred.

Main advantage of this treatment was early mobilization to enhance union and to reduce the cost of hospitalization.

Cortwell (1978) treated a series of 30 patients with fractures of femoral shaft by closed reduction, tibial pin traction for 3 to 6 weeks and early ambulation with crutches in plastic thigh lacer. The goal of treatment of a femoral shaft fracture was the restoration of normal function of limb in shortest possible time. The average hospital stay was 58 days. The degree of residual angulation at fracture site was less than 5 degree in 17 patients. The greatest degree of angulation encountered was 16 degree. In 8 patients shortening was 1 to 2 centimeters. At follow up, the range of motion of knee was greater than 125 degree. The earliest that any patient was allowed partial weight bearing was 17 days. The average convalescence took 4.1 months with a range of 3 to 8 months.

Hardy, White and Williams (1979) treated 79 cases of fracture of femoral shaft by cast brace at Middle. More hospital between July 1974 and January 1977. Many of the cast brace applied with the hip in neutral position but in many cases no note was made of the position of the hip at the time of application.

Six patients were left with flexion contractures of the knee, the contracture was between 5 to 10 degree in 6 patients. Seven patients were left with less than 90 degree of flexion. No patient had a valgus or varus deformity greater than 20 degree. Deformity between 16 to 20 degree occurred in 4 patients, between 11 to 15 degree in 9, between 6 to 10 degree in 29 patients, while 37 patients had less than 5 degree of malalignment. Thirty six of the 79 cast brace were applied within the first 28 days. The mean femoral shortening for the 64 patients was 1.63 centimeters. 54 patients claimed to be aware of some shortening, 22 had at some stage worn a heal raise. Four femoral refractures were noticed after removal of cast brace, all within first month of removal of brace.

Discrepancy in femoral length was assessed by scanogram. The cases were analysed to relate the incidence of shortening greater than 2 centimeters to the type and site of fracture and the time which elapsed from injury until the cast brace was applied. Such shortening encountered most frequently when the cast brace was applied within the first two weeks from injury or after 6 weeks in those patients with comminuted fracture of middle third of femur.

Dhaon, Sharma and Sankaran (1979) conducted a study of cast bracing as a treatment of fracture shaft

femur. The purpose of the study was to determine whether cast bracing technique would allow patient to achieve even earlier ambulation than had been possible before and perhaps a shorter period of hospitalization.

Eighteen patients were treated by sustained traction initially either by skeletal or skin traction. Out of these, 8 patients were treated by reduction and immobilization in plaster hip spica. In the remaining 10 patients traction was continued till the fracture became sticky. Then cast brace was applied to the average period of 4 weeks. The results were classified as follows :

Excellent : Shortening less than 1.5 centimeter, no angulation or rotation, knee flexion 90 to 135 degree, return to normal work.

Good : Shortening 1½ to 2½ centimeters, 5 to 10 degree rotation or angulation deformity. Knee flexion upto 45 to 90 degree, return to normal work but with reduced efficiency.

Poor : More than 2½ centimeter shortening, more than 20 degree rotation or angulation.

The overall results were : excellent-15,cases, good-3 with no poor case.

Two patients developed shortening upto 2½ centimeters, both had compound comminuted fracture of middle third femur. In no instances there was non-union.

The average hospital stay of patients was 11 weeks. Union was rapid, infection was avoided and good knee motion maintained when fracture united.

Maini, Mudgal and Dahiya (1985) treated forty cases of fracture shaft femur initially by skeletal traction followed by the application of functional thigh brace of low density polyethylene which moulded individually for each patient. The primary goal in the management of a patient with fracture is to achieve an early osseous union with minimal or no deformity and maximum return of extremity functions.

Skeletal traction was continued till intrinsic stability developed at the fracture site and there was evidence of callus formation on roentgenograms. This was followed by application of functional thigh lacer brace. After application of the brace, the patients were encouraged to do active and passive motion exercises for hip, knee and ankle joints, and were encouraged to walk gradually with the help of crutches.

For the proximal fractures, the classical brace was modified by adding a pelvic band and hip hinge in 20 degree valgus to avoid varus angulation. Average period of skeletal traction was 34 days and union occurred on an average at 15.2 weeks. None of the patients had less than 90 degree of knee novements at the end of treatment and

the overall results were good in 82 percent cases. Shortening of the limb of less than 1 centimeter was seen in 10 cases, 1 to 2 centimeter in 16 cases and 2-3 centimeters in 4 and more than 3 centimeters in two patients. Result were good in 33 patients, fair in 5 and poor in 2 cases.

The polyethylene functional brace was light in weight, adjustable (can be loosened and tightened) washable, removable for personal hygiene and was economical as well.

Bhalla, Agrawal and Labo (1985) treated a series of 28 patients with unilateral fracture of the shaft femur by upper tibial skeletal traction on Bohlar Braun splint. An effort was made to reduce the fracture within 4 to 5 days by traction alone. Manipulation under sedation was used to improve the position, where adequate reduction was not obtained. The thigh lacer was applied when the swelling had resolved and wound had healed. Thigh lacer was made up of polyethylene high density sheet, according to measurement of individual's thigh. The thigh lacer was washable and was opened for hygienic purposes.

The lacer was applied at the earliest at one week and was delayed for maximum of 8 weeks. In most of the patient lacer was applied within 3 weeks. An average period of confinement to bed was 4.9 weeks. The earliest crutch walking was at 18 days in 2 cases and latest was

8.5 weeks. The average hospital stay was 7 weeks. The thigh lacer was discarded only when there was radiological evidence of union. The average period of union was 14.41 weeks.

Average angulation in antero-posterior plane was 10.57 degree and in lateral plane 9.14 degree. Shortening was seen in 6 cases. After an average follow-up of 11.5 weeks the results would be improved to excellent in 78.57 percent and good in 21.43 percent cases.

Bansal, Singhal, Singh and Arora (1985) treated 25 cases of fracture shaft femur by open reduction, Kuntscher nailing and early mobilization with the help of functional cast bracing applied on an average of 12th post-operative day. Patient was then mobilized first with partial weight bearing and finally full weight bearing. The cast was discarded in cases of solid union.

Twenty (80 percent) cases united between 6 to 12 weeks, with an average period of union being 9 weeks. Superficial infection was noted in 2 patients, loosening of cast brace in another two patients and in one patient angulation of 20 degree was noted. In most of patients there were knee movements more than 90 degrees. The overall results were good in 23 patients, satisfactory in one and poor in 1 patient.

Agarwal, Potukuchi, Dhaon and Das (1985) treated fifty two closed fracture of femoral shaft in patients above the age of 16 years by open reduction and Kuntscher intramedullary nailing followed by immediate cast bracing. In addition to this, 20 cases each were treated either by nailing alone or by bracing alone during the same period. The results were compared by same parameters like clinical union, radiological union, duration of hospital stay, time of full weight bearing and return to work; and the range of knee movements. Quadriceps wasting and limb shortening were also assessed at the completion of treatment and compared.

The average period of clinical union was in Kuntscher nailing with cast brace 8.8 weeks. In Kuntscher nailing alone 11.3 weeks. In traction with brace 10.1 weeks. The average period of radiological union was in Kuntscher nailing with cast brace 15 weeks, in Kuntscher nailing alone 24.6 weeks and in traction with cast brace 15.1 weeks. The average hospital stay was 3.3 weeks in Kuntscher nail with cast brace, 6.2 weeks in Kuntscher nail and 6 weeks in traction with cast brace. Full weight bearing was 5.6 weeks with Kuntscher nail with cast brace, 12.9 weeks with Kuntscher nail and 9.1 weeks with traction and cast brace. Return to work was 10 weeks with Kuntscher nail and cast brace, 13.1 weeks with Kuntscher nail and 10 weeks with traction and cast brace.

Open reduction and internal fixation with Kuntscher nailing has the distinct advantage of accurate opposition, decreased hospital stay and better functional end-results. Kuntscher nailing with cast bracing combines the benefits of surgery as well as bracing. Many of patients of this series attended office and returned to sedentary occupation while still in the brace.

Bhalla et al (1988) conducted a comparative study of ambulatory treatment of fracture shaft femur by nailing and by thigh lacer. They treated 20 cases of femoral shaft fracture with intramedullary nailing (Group I) and equal number with thigh lacer (Group II). The average duration from injury to nailing was 1.9 weeks. Whereas thigh lacer was applied as an average of 3.3 weeks post-injury. Patients were ambulatory as early as possible, the average duration being 4.1 and 4.8 weeks respectively in nailing and thigh lacer group. Average hospitalization was about 2 weeks more in group II. In nailing it was 4.4 weeks against 6.3 weeks in group II. There were no case of non-union. The average duration of union being 18.5 weeks and 17.6 weeks in group I and II respectively. In group I two patient developed infection and loosening of nail, while in group II, two patients each had significant shortening and varus deformity. According to grading of results at the time of union in nailing group, 69 percent achieved excellent, 24 percent good and 7 percent fair

results among the 19 cases of nailing. In thigh lacer group 65 percent had excellent and 35 percent had good results at the time of union. These results were further improved to 85 percent excellent and 15 percent good with later follow-up. The other advantage of thigh lacer treatment is free from operative complications. The quality of union was always better in thigh lacer group of patients with good callus sleeve.

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MATERIAL AND METHODS

MATERIAL AND METHODS

The proposed study "Thigh lacer with Kuntscher nailing in the management of fracture shaft femur" was conducted in the Department of Orthopaedics, M.L.B.Medical College and Associated Hospital, Jhansi, through the concerned Out Patient Department and the Casuality Department. A total of 18 cases of fracture femoral shaft was treated with above said method from March 1990 to February 1991.

All the suitable adult patients with fracture of femoral shaft, attending the Orthopaedics Department irrespective of sex were included in the study.

CRITERIA FOR SELECTION OF CASES

All the patients with simple fracture or grade-I type of compound injury of femur were selected for the study except following -

1. Children.
2. Compound injury except of more than grade-I nature.
3. Fracture shaft femur associated with other fracture of lower limb.
4. Type of fracture :

a) too near to either end of bone,

b) gross comminution,

c) Long oblique and long spiral fracture.

MANAGEMENT OF FRACTURE

As soon as the patient was admitted, he was given first aid management in the form of below knee skin traction on Thomas splint along with intravenous fluids and analgesics. If the injury is grade I compound fracture, then proper cleaning and dressing of wound and a broad spectrum antibiotics started.

Cases who were fit for nailing underwent following pre-operative evaluations :

1. General assessment of vital parameters :

   a) General condition of patient,

   b) Blood pressure,

   c) Pulse,

   d) Routine examination of other systems.

2. Local examination of skin at and away from fracture site including examination for associated neurovascular involvement.

3. Radiological examination done :

   a) For the type and site of fracture,

   b) Diameter of nail required.

4. Investigations :

a) Routine,

b) Specific.

After the above procedure were done, the data were collected and recorded as follows :

Case No. M.R.D. No.

Name of patient Age/Sex

Address

Date of admission

Date of Discharge

Brief History :

Date of injury

Mode of injury

Any associated injury

Fracture :

Side : Right / Left / Both

Site : Proximal / middle / distal

Bone involved : femur

Nature of injury : Simple / grade I (punctured wound)

Comminution : Present / Not present

Fracture line : Transverse / oblique / spiral

Treatment : Date of first aid treatment and traction application.

APPARATUS AND INSTRUMENTS

Apart from the general set of instrument, following are specially required :

1. Metal ruler which could be autoclaved to measure the length of nail required.
2. Kuntscher nail gauge to assess the diameter of nail per operatively.
3. Kuntscher medullary nails of various size and diameter.
4. Guide wires.
5. Reamers of various diameter.
6. Mallet.
7. Driving punch for the nail.
8. Universal nail extractor with hook.
9. Hacksaw.

OPERATIVE PROCEDURE

After appropriate anaesthesia was given, the patient was laid supine with the sand bag over upper part of gluteal region on affected side on the ordinary operation table.

Fracture was exposed through the lateral incision. After exposing the fracture, first mobilized the fragments and reduced the fracture with due regard for correct

rotatory alignment. Next the distal fragment was delivered from the wound and size of medullary canal with medullary reamer was checked. The length of medullary canal of distal fragment was measured with the help of guide wire until resistance was felt. Now the proximal fragment was delivered, reamed appropriately and size of medullary canal with the help of medullary reamer was measured and length was measured with guide wire until resistance was felt against the greater trochanter. So the appropriate length and diameter of Kuntscher nail was selected. The nailing was performed by retrograde method. The Kuntscher nail with the eye postero-medially and open slot antero-laterally was hammered through proximal fragment keeping the hip adducted and flexed. A short incision was made over the point of its emergence from the greater trochanter. The Kuntscher nail was hammered till nail was flush with proximal fragment. The fragments were reduced in correct position and alignment than nail hammered slowly in distal fragment and wound is closed.

Compression bandage was applied and Listen splint applied.

POST-OPERATIVE MANAGEMENT

Post-operative check X-ray taken for confirmation of extent of nail and fracture alignment. On an average of 4-5th post-operative day, quadriceps drill exercise was

begun. On an average of 7th day, knee bending exercise was started.

Stitches were removed on 12th day and functional thigh lacer is given on 15 - 18 days after operation. On the same day patient allowed to bear partial weight with the help of crutches. As soon as patient developed confidence in weight bearing and there is no pain at fracture site, he was permitted to bear full weight gradually.

FABRICATION OF FUNCTIONAL THIGH LACER

The method of preparing the thigh lacer comprised of 4 stages.

1. Impression taking.
2. Making of Plaster of Paris mould.
3. Moulding of plastic sleeve.
4. Final trimming and fitting of lacer.

1. Impression taking :- Patient was made to lie supine and a thin plaster of Paris cast around the injured thigh was then applied. It was carefully moulded to take up all the contours of the thigh. The extent of the impression was proximally on the lateral side upto just below the tip of the greater trochanter, anteriorly about 2.5 cm distal to inguinal ligament, posteriorly just below the gluteal fold and medially 2.5 cm distal to ischial tuberosity.

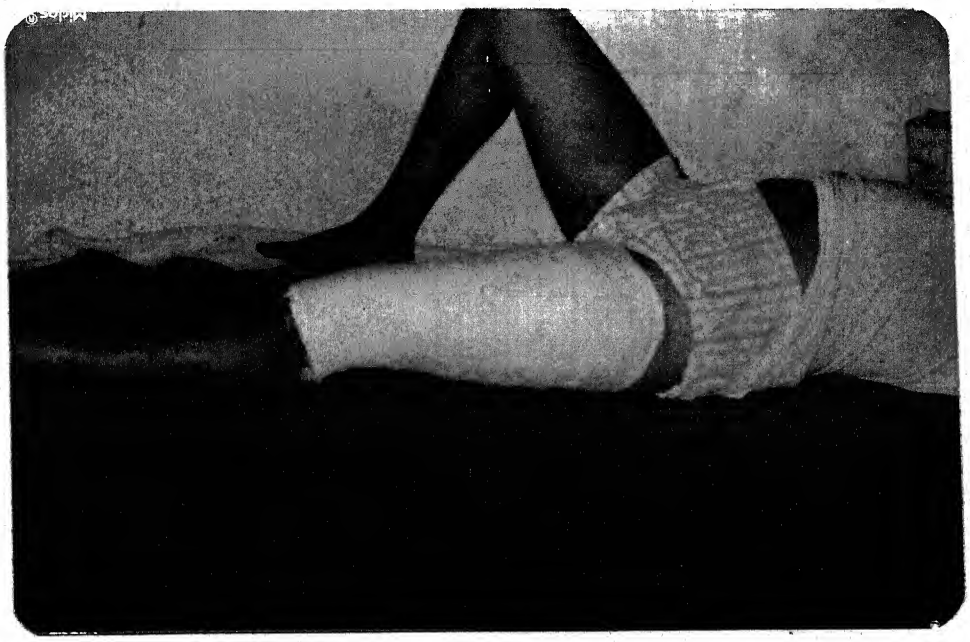
The impression extended distally upto distal pole of patella. The plaster impression dried up in about 5-10 minutes and was then taken off the thigh by longitudinal slitting of anterior side.

2. Making of Plaster of Paris mould :- All the opening of the impression were sealed by plaster of Paris bandage except the upper one, through which the semi-solid paste of plaster of Paris was poured into the cylindrical impression. In about 10-15 minutes, the outer thin impression was stripped off leaving behind the positive plaster mould. Hand finishing of the mould was done wherever required.

3. Moulding of Plastic Sleeve :- The thigh lacer was made from low density polythene 3 mm. thick sheet. The sheet is cut according to the measurement of the plaster mould. This was heated in the oven upto 200 degree C. for about 20 minutes and then snuggly drapped and moulded over the plaster of Paris mould, keeping the opening anteriorly.

4. Final trimming and fitting of brace :- The margins of plastic sleeve were trimmed and finished according to extent of the lacer. Proximally the lateral side of the plastic cylinder extended upto just below the tip of greater trochanter, anteriorly about 2.5 cm distal to inguinal fold to allow full flexion of hip joint, posteriorly below the gluteal fold and medially about 2.5 cm distal to perineal

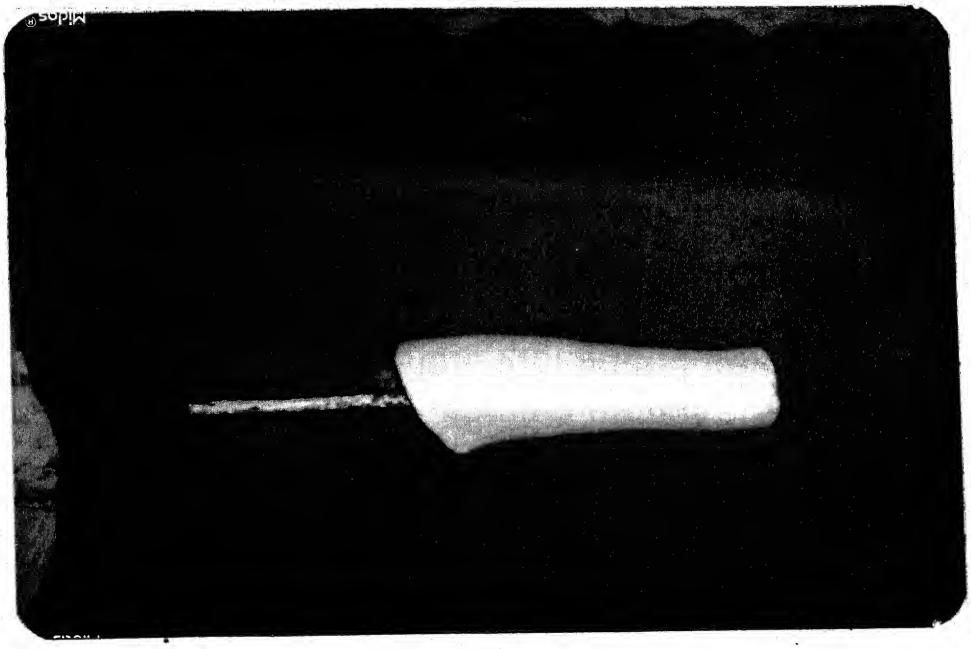
FABRICATION OF THIGH LACER



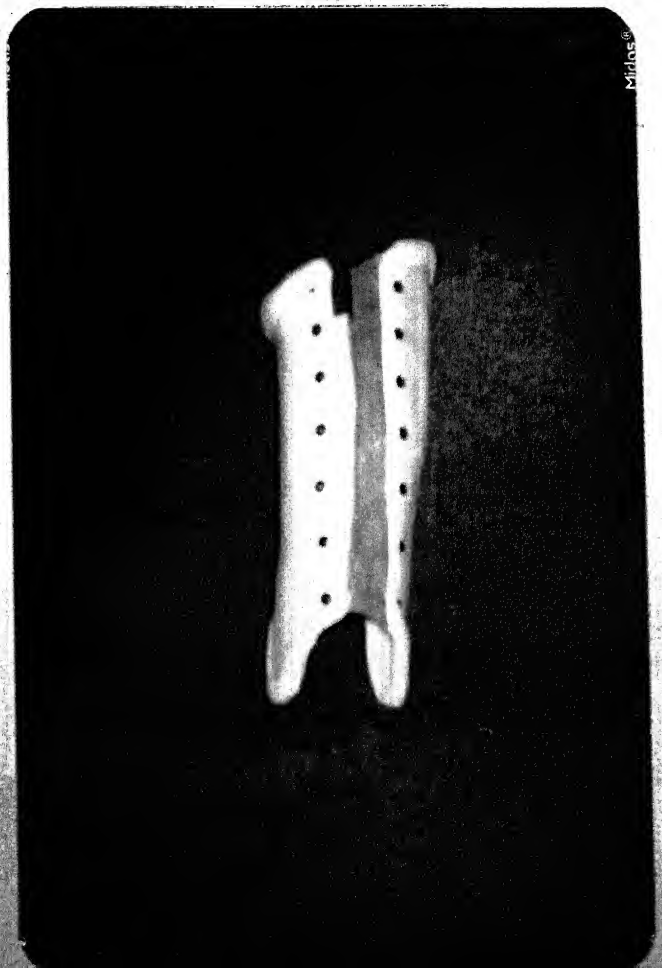
Plaster of Paris impression taking of thigh.

Plaster of Paris Impression, longitudinally slitted on anterior side (Negative).

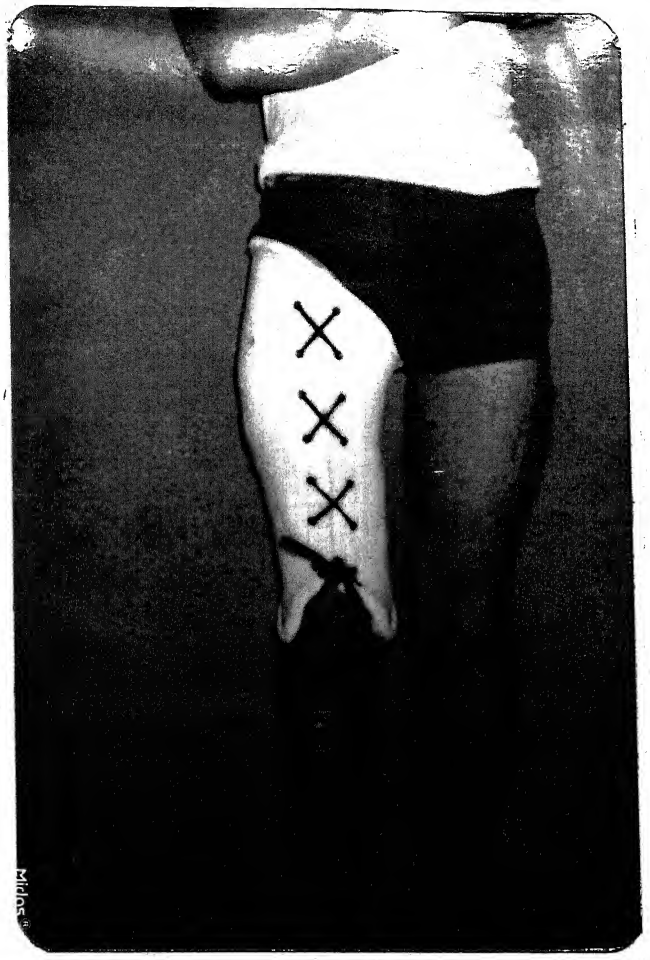
FABRICATION OF THIGH LACER



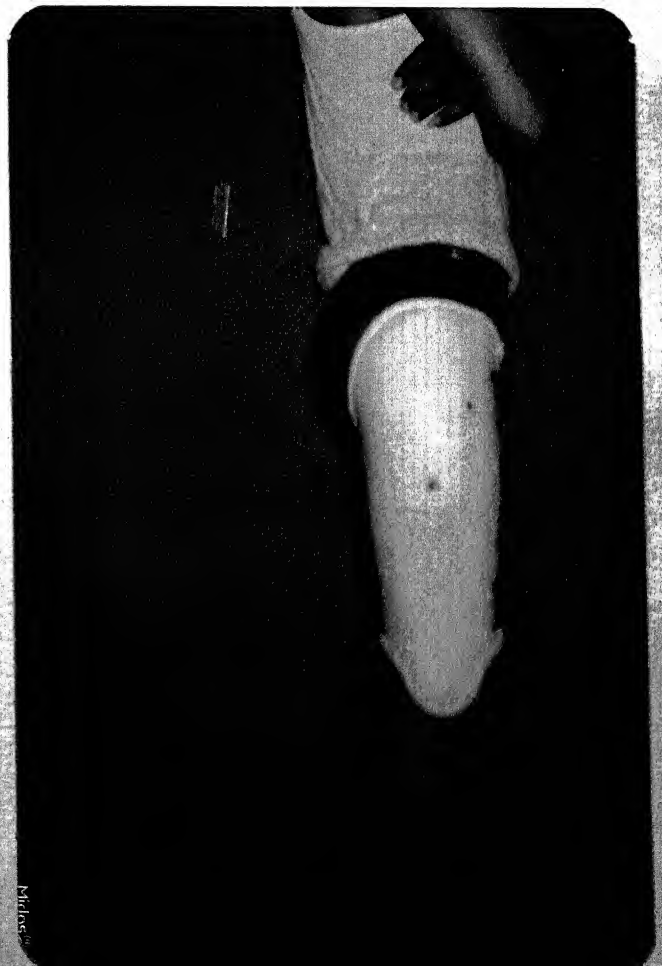
Finished cylindrical plaster mould (Positive) of thigh. The plastic sleeve moulded over this positive.



Finished thigh lacer, having opening anteriorly.



Anterior view

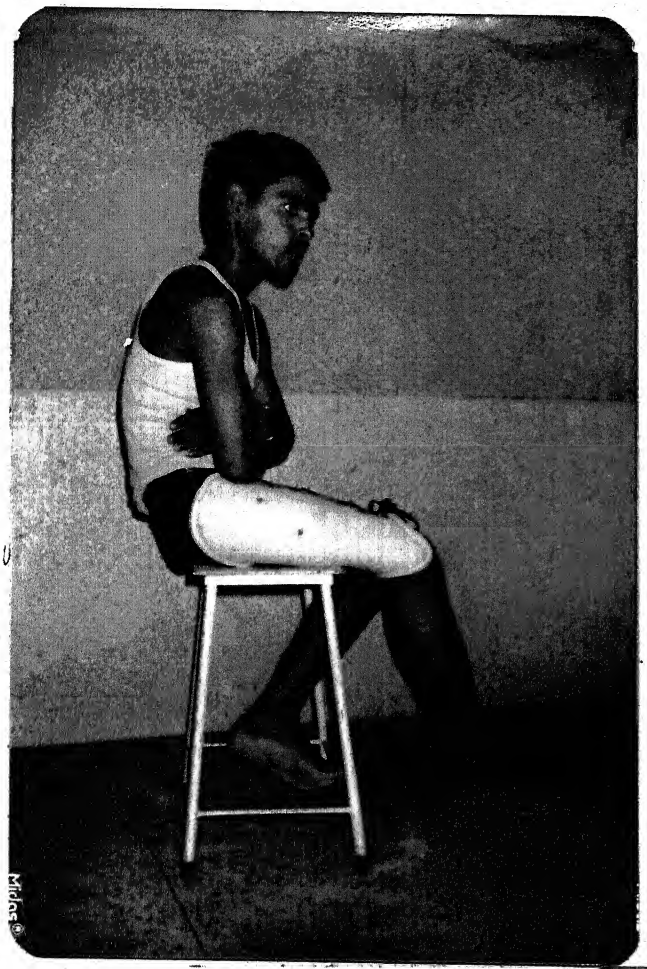


fold to avoid impingement of the adductors. The brace extends distally upto the upper pole of patella anteriorly, laterally over the condyles of the femur and posteriorly about 2.5 cm above the level of the proximal pole of the patella to allow full flexion of knee without impingement of the hamstrings. A leather felt piece was fixed along the one side edge of the opening on anterior side to avoid pinching effect of margins during fastening. Multiple eyelets were fixed on both the margins of the opening for fastening with the lace. Ten mm thick foam was applied on the margins to avoid pinching of the margins. Holes of 10 mm in diameter were drilled in the sleeve for areation. Three mm thick foam was fixed on the inner aspect of the lacer with adhesives.

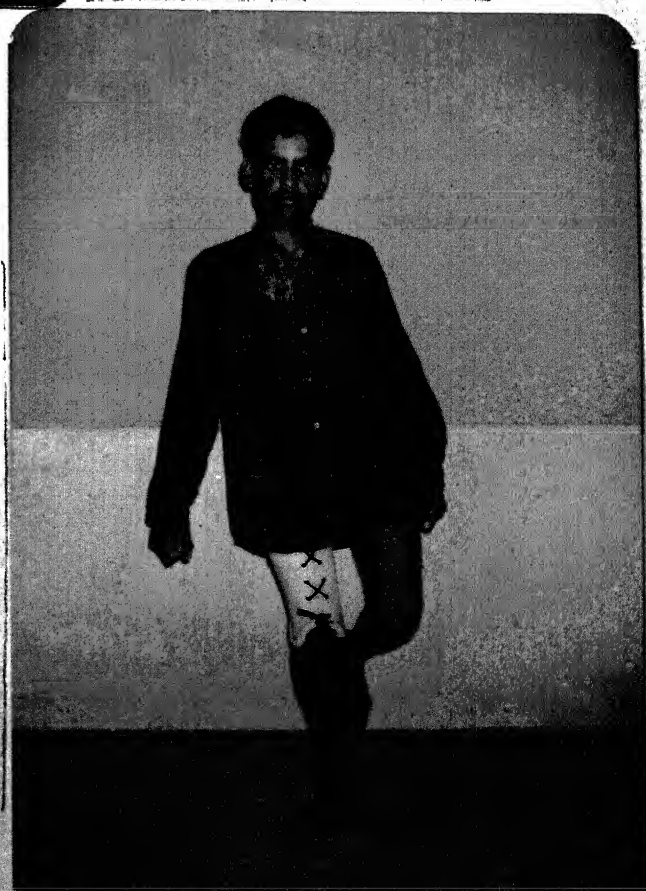
Management of the patient with thigh lacer :-

Active quadriceps exercise was encouraged 4-5 days after intramedullary nailing of femur. The thigh lacer was applied 15 - 18 days after operation, because reactionary swelling of the thigh subsided by this time. The patient was encouraged to actively extend the knee and to perform the active straight leg raising while in lacer. The partial weight bearing started, from very first day with the help of pair of crutches. At the time of discharge from hospital, the patient was instructed to continue quadriceps exercise and to bear weight as much as possible

PATIENT FITTED WITH THIGH LACER



Active knee flexion immediately after thigh lacer applied.



Unsupported weight-bearing after 4 weeks in lacer (6 weeks after surgery)

with crutches. They were called for the follow-up every 4 weeks. As soon as the patient started to bear full weight and there was no pain on weight bearing, he was advised to walk with help of one crutch only. This was possible in about 4 to 6 weeks after wearing the thigh lacer. Soon after this, the tenderness at fracture side was disappeared or very minimal, the patient was asked to walk with help of a stick.

The thigh lacer was washable and was opened occasionally for hygienic purpose, however the patients were discouraged to remove the lacer very oftenly. When clinical and radiological union were achieved the thigh lacer was discarded.

FOLLOW-UP

The patients were discharged at a suitable time with detailed instruction regarding do's and don'ts and were followed up clinically and radiologically at 4, 8, 12, 16 weeks interval.

All relevant data were filed and tabulated in the following way so as to reach the final results.

a) Wound scar : Healthy linear scar/unhealthy scar.

b) Callus : Radiologically -

at weeks - 8

- 12

c) Movements of knee joint measured in degrees

	Flexion	Extension
Weeks - 4		
- 8		
- 12		
- 16		

d) Date and time of removal of thigh lacer.

e) Return to employment.

EVALUATION OF RESULTS

The results were evaluated as good, fair or poor on the basis of various parameters as given below.

	Good	Fair	Poor
1. Symptoms :			
Pain at fracture site while bearing weight.	No pain.	Mild pain.	Unable to bear weight.
Return to work.	Light work.	Able to do own personal hygiene.	Unable to walk.
2. Signs :			
Infection	None	Superficial stitch line infection	Deep infection.
Distraction	None	None	Present
Bending of nail	None	None	Present
Malunion	None	None	Present
Non-union	None	None	Present
Shortening	None	$\angle$ 1 cm.	$\nearrow$ 1 cm.
Knee movement	$\nearrow$ 90°	$\nearrow$ 45°	$\angle$ 45°
3. Radiology :			
Callus formation after			
4 weeks	Good	Moderate	Poor
8 weeks	Good	Moderate	Poor

OBSERVATIONS

OBSERVATIONS

In the present study, a total of 18 cases of fracture shaft femur were treated by open reduction and Kuntscher's nailing followed by functional thigh lacer bracing for earlier weight bearing, in the Department of Orthopaedics, M.L.B. Medical College and Associated Hospital, Jhansi.

1. AGE DISTRIBUTION -

Age-wise break up of patient is shown in table I. Age of patient varied from 18 to 47 years. Maximum number of cases (about 72.25 percent) belonged to age group ranging from 16 - 27 years. The youngest patient to undergo nailing was 18 years.

TABLE - I

Showing the age distribution of patients.

Age group (years)	No. of cases	Percentage
16 - 27	13	72.25
28 - 37	4	22.25
38 - 47	1	5.50
Total	18	100.00

2. SEX INCIDENCE -

The male outnumbered the female, as out of 18 cases, 17 were male and one was female.

TABLE - II

Showing sex incidence of the patients.

Sex	No. of cases	Percentage
Male	17	94.5
Female	1	5.5
Total	18	100.0

3. OCCUPATION OF THE PATIENTS -

According to the occupation, patients were divided into light workers (housewives, student, unemployed) and heavy workers (Farmers, labourers, businessmen). Out of 18 cases, the light workers carried 10 cases and heavy workers were 8 cases.

TABLE - III

Showing occupation of the patients.

Occupation	No.of cases	Percentage
Light workers	10	55.5
Heavy workers	8	44.5
Total	18	100.0

4. MODE OF INJURY -

In six cases mode of injury was fall from height or fall while running, whereas roadside accident contributed 66.6 percent of total injury and no case was reported due to industrial accident.

TABLE - IV

Showing mode of injury.

Mode of injury	No.of cases	Percentage
Fall	6	33.3
Roadside accident	12	66.7
Industrial accident	-	-
Total	18	100.0

5. SIDE INVOLVED -

Out of 18 cases, 9 cases had fracture of left and 9 had fracture of right femur.

TABLE - V

Showing side of involvement.

Side involved	No.of cases	Percentage
Right	9	50.0
Left	9	50.0
Total	18	100.0

6. LEVEL OF FRACTURE -

Majority of cases in present study had the fracture of middle one third (15), followed by fracture at the junction upper third and mid-third femur shaft (2 cases). (Diagram).

7. TYPE OF FRACTURE -

In this series 50 percent patients had transverse type of fracture and remaining 44.5 percent had short oblique fracture and 5.5 percent had comminuted fractures.

LEVEL OF FRACTURE

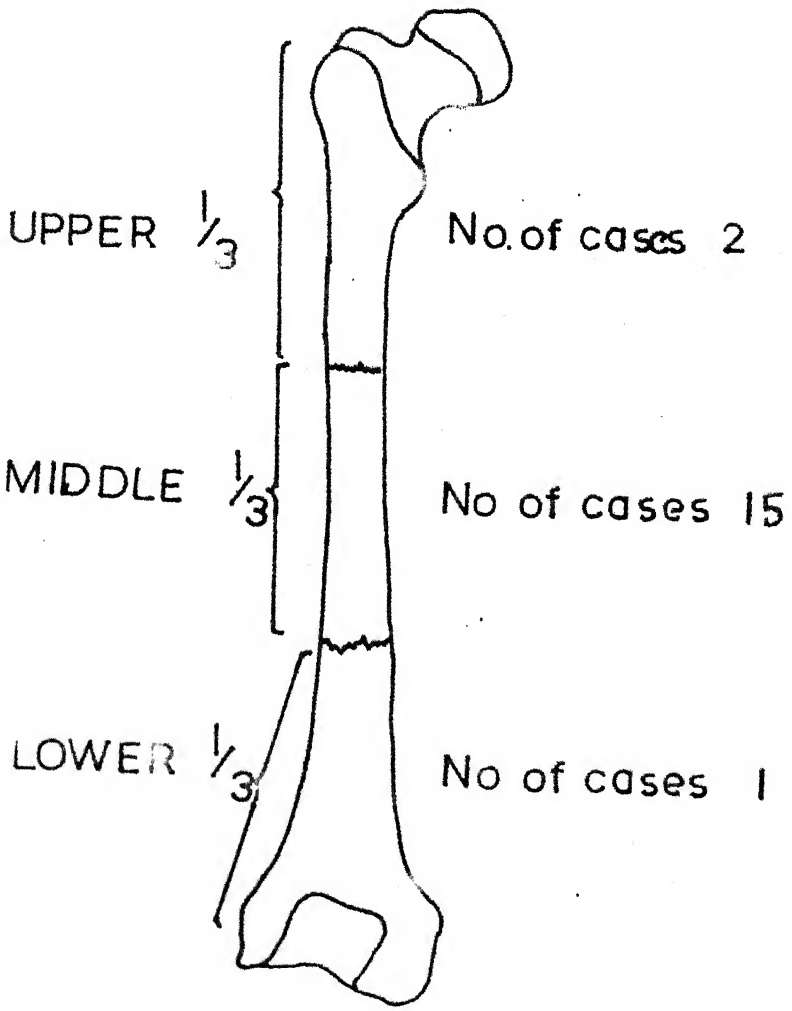


TABLE - VI

Showing type of fracture in patients.

Type of fracture	No.of cases	Percentage
Transverse	9	50.0
Short oblique	8	44.5
Comminuted	1	5.5
Total	18	100.0

8. INCIDENCE OF ASSOCIATED INJURY -

In our study, about 22 percent cases had the associated injury.

TABLE - VII

Showing incidence of associated injury.

Type of associated injury	No.of cases
Fracture ribs	1
Head injury	2
Fracture medial malleolus	1
Total	4

9. TIME INTERVAL BETWEEN INJURY AND NAILING -

In about 55 percent of cases Kuntscher's intramedullary nailing was done within 10 days. The shortest time interval between injury and nailing was three days and longest was thirty days.

TABLE - VIII

Showing time interval between injury and nailing.

Time interval	No.of cases	Percentage
0 - 10 days	10	55.50
11 - 20 days	5	27.75
21 - 3 weeks	3	16.75
Total	18	100.00

10. TIME INTERVAL BETWEEN NAILING AND THIGH LACER -

Out of 18 cases, in 17 cases of time interval between the nailing and thigh lacer was between 16-18 days (about 94.5 percent).

TABLE - IX

Showing time interval between nailing and thigh lacer.

Time interval	No.of cases	Percentage
16 - 18 days	17	94.5
19 - 20 days	1	5.5
Total	18	100.0

11. DURATION OF THIGH LACER -

In present study the thigh lacer was removed after 8 weeks and in three cases thigh lacer used upto 10 weeks and in one case upto 12 weeks. One case lost follow-up.

TABLE - X

Showing duration of thigh lacer.

Duration of thigh lacer	No.of cases	Percentage
8 weeks	13	72.25
9 weeks	-	-
10 weeks	3	16.75
11 weeks	-	-
12 weeks	1	5.50
Total	17	

12. DIAMETER OF KUNTSCHER'S NAIL -

In most cases either 10 mm or 11 mm diameter of nail was used for intramedullary fixation.

TABLE - XI

Showing diameter of nails used in patients.

Diameter of Kuntscher's nail in mm.	No.of cases	Percentage
8	-	-
9	2	11.25
10	7	38.75
11	8	44.50
12	1	5.50
Total	18	100.00

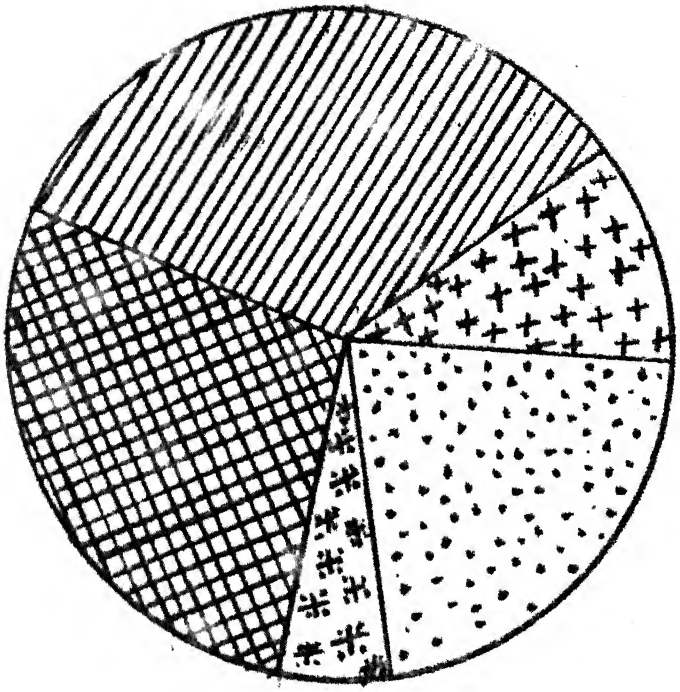
13. KNEE MOVEMENTS AFTER NAILING -

A. After 2 weeks - Only 5 patients had more than 30 degree of knee movements and rest 72.5 percent cases had the range of movements upto 30 degree. The maximum knee movement noted was 50 degree while the minimum movements was 10 degree. (PIE DIAGRAM No. 1).

B. At 6 weeks -

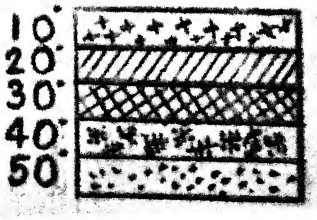
Fifteen patients had the knee movements upto 90 degree, while 3 patients had movements more than 90 degree. No patient had full range of knee movement (PIE DIAGRAM No. 2)

KNEE MOVEMENTS AFTER TWO WEEKS

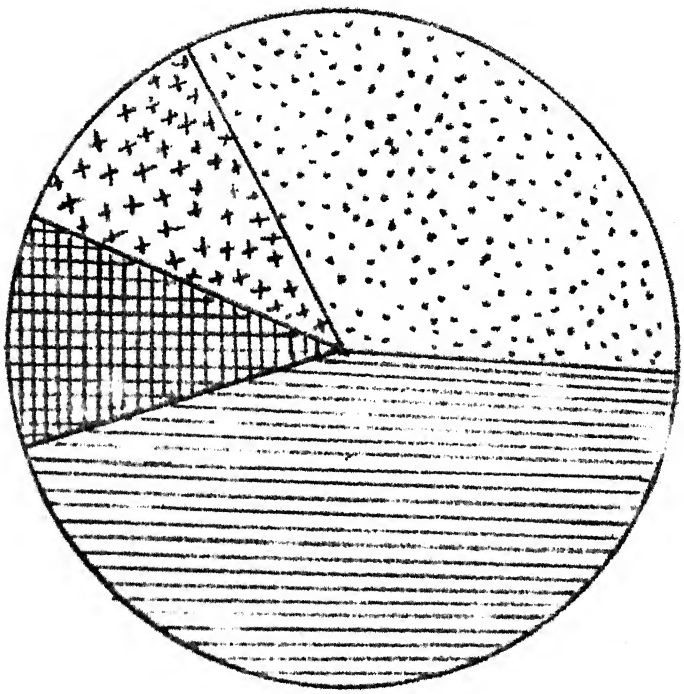


PIE DIAGRAM No. 1

INDEX



KNEE MOVEMENT AFTER SIX WEEKS



PIE DIAGRAM No. 2

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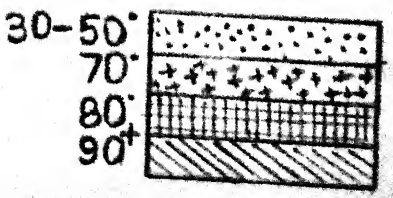


C. At 10 weeks -

At the end of 10 weeks only two patients had less than 90 degree of knee movements and rest 83.5 percent had movements more than 90 degree, of which 3 patients had full range of movements. One patient lost the follow-up. (PIE DIAGRAM No. 3).

D. At 14 weeks -

Thirteen cases achieved full range of knee movements and two patients had less than 90 degree of movements.

TABLE - XII

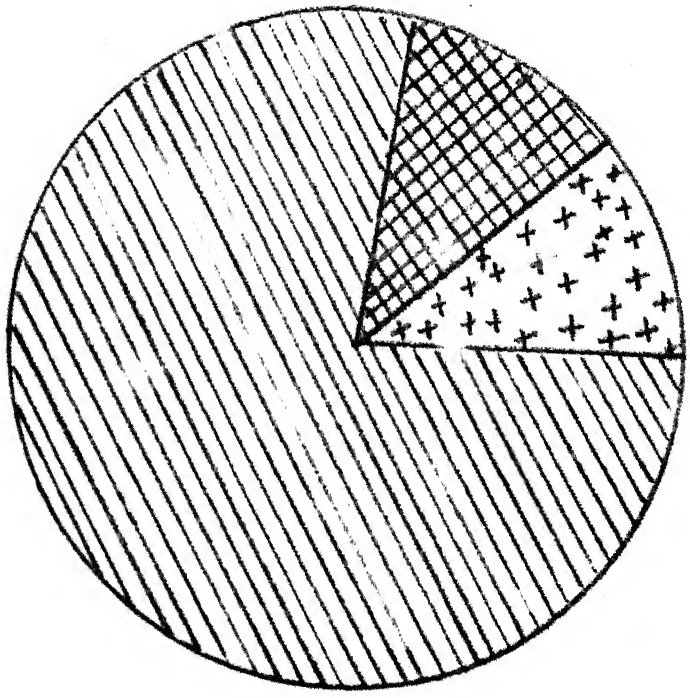
Showing degree of knee movements in follow-up.

Degree of knee movements	2 weeks	6 weeks	10 weeks	14 weeks
∠ 45	15	3	-	-
45 - 90	3	7	2	2
7 90	-	8	12	2
Full range of movement	-	-	3	13
Total	18	18	17	17

14. COMPLICATION OF KUNTSCHER'S NAILING -

In our present study of 18 cases there were no complication of nailing like deep infection, distraction and bending of nail. Only one patient developed superficial infection.

KNEE MOVEMENT AFTER TEN WEEKS



PIE DIAGRAM No. 3

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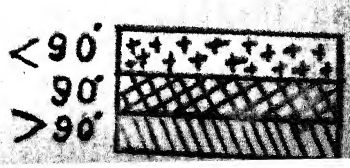


TABLE - XIII

Showing complication of nailing.

Complication	No.of cases	Percentage
Superficial infection	1	5.5
Deep infection	-	-
Shortening more than 1 cm.	-	-
Distraction	-	-
Bending of nail	-	-
Malunion	-	-
Non-union	-	-
Migration of nail	-	-
Total	1	5.5

15. COMPLICATION OF THIGH LACER -

In our series three patients developed complication in thigh lacer. One patient developed swelling of knee joint and leg while other had superficial skin infection. In one case thigh lacer was broken near the popliteal region.

TABLE - XIV

Showing complication of thigh lacer.

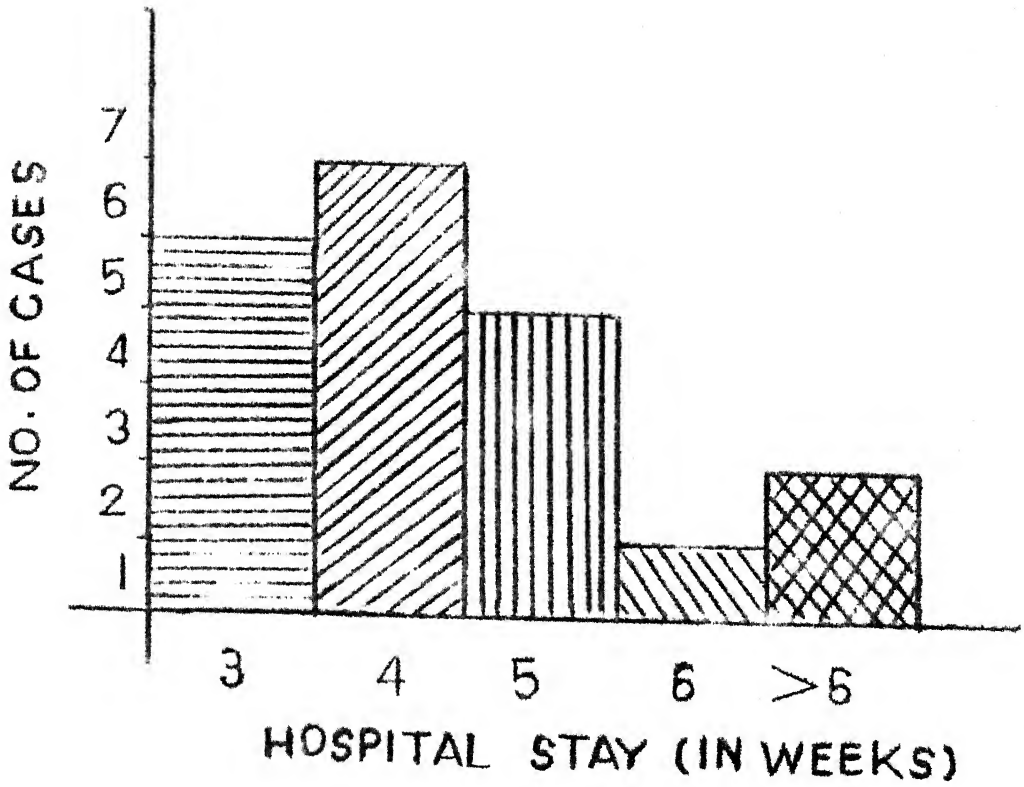
Complication of thigh lacer	No.of cases	Percentage
Superficial skin infection	1	5.5
Swelling over knee joint	1	5.5
Breaking of lacer near popliteal region	1	5.5
Total	3	16.5

16. DURATION OF HOSPITAL STAY -

In majority of cases (78 percent), the duration of total hospital stay was 3.7 weeks. The minimum duration of hospital stay was 22 days in two patients and 46 days was maximum stay in case of two patients. Four patients of our series could not be operated upon early because of other serious injuries like head injury and burn injury. The average duration of hospital stay after surgery was 17 days, while average total hospital stay was 4.3 weeks. (BAR DIAGRAM).

17. PERIOD OF FOLLOW-UP -

In our study one patient lost to follow-up. Thirteen cases came in follow-up for 14 weeks and four cases came in follow-up more than 14 weeks after nailing.



BAR DIAGRAM

TABLE - XV

Showing period of follow-up of cases.

Period of follow-up	No.of cases	Percentage
Upto 14 weeks	13	72.50
More than 14 weeks	4	22.00
Loss of follow-up	1	5.50
Total	18	100.00

18. RETURN TO WORK -

Our study included 7 students, one housewife and nine working persons. The students and housewife joined their works within four weeks, while working persons resumed their work on an average of 6 weeks with bearing thigh lacer. One patient who was driver changed the job after 22 weeks because of restricted movements of knee joint.

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DISCUSSION

DISCUSSION

The goal of fracture treatment is complete restoration of the normal anatomy and function of the injured part at the earliest possible time. To achieve this, the management of femoral shaft fracture has been divided between open reduction and internal fixation on one hand and conservative treatment in traction and plaster spica cast on the other. To this has been added, more recently, the concept of functional bracing. The thigh lacer treatment of femoral shaft fracture utilizes the principle of functional bracing with the application of external support to a limb with a fracture so that maximal use during healing may occur. Early ambulation while a fracture is healing seems to provide an opportunity for rapid bone healing while allowing maintenance of joint movement and muscle action so that they are at a functional level at the completion of treatment. The most desirable end result of an extremity fracture is a limb capable of full function as soon as the fracture is healed.

The present study, though in small, may attempt to evaluate a series treated by Kuntscher's intramedullary nailing with thigh lacer (18 cases). The greater emphasis

has been on the role of high lacer and early ambulation in the management of femoral shaft fracture to enable the patient to return his employment in shortest possible time.

The disadvantages of conservative treatment in femoral shaft fracture are :

1. Prolonged immobilization leading to knee stiffness.
2. Quadriceps muscle wasting.
3. Malunion.
4. Degree of angulation and displacement within the cast.
5. Non-union.
6. Shortening of more than 2 cms (Stryker et al, 1970; Anderson, 1967 and Carr, 1973).

Open reduction and internal fixation with Kuntscher's intramedullary nailing has the distinct advantages of -

1. Accurate reduction and apposition.
2. Decreased hospital stay.
3. Better functional result.

In addition to this, the pain is relieved and patient may sit up the day after the operation and turn on his side. The dangers of pneumonia and circulatory failure is minimised. The danger of thrombosis and emboli is lessened.

But open reduction and fixation exposes the patient to hazards of anaesthetic agents, infection, and implant failure (Dencker, 1965; Kafer, 1972) and moreover large numbers of femoral shaft fractures are not amenable to rigid internal fixation by nail.

By taking all the points of advantage and disadvantage into account, the internal fixation by Kuntscher's intramedullary nail is choice of treatment in femoral shaft fractures and to this functional bracing adds following advantage in management.

1. Shortens hospital stay (Wardlaw, 1977).
2. Promote the healing of fracture.
3. Diminishes the risk of knee stiffness and limb shortening.
4. Allows early return to work.
5. Yields more satisfactory functional result.

In our study of 18 cases series, the maximum number of patients were between 16 to 30 years of age and male (94.5 percent) outnumbered the female (5.5 percent), which could be due to their more active outdoor life, making them more prone to trauma.

In the series of Agarwal et al (1985) and Bensal et al (1985), treated closed femoral shaft fracture by

open reduction and Kuntscher's nailing, followed by immediate cast brace, the male patient outnumbered the female and the age of patient varied 13 to 65 years.

Most of injuries were roadside accidents (66.6 percent) and majority of patients (80 percent) had fracture of middle third of shaft femur followed by fracture of upper third of femoral shaft. In Bansal et al (1985) series, about 80 percent fractures were in middle third of shaft femur. In Agarwal et al (1985) series, about 50 percent of cases had fracture of mid third of shaft femur followed by upper third. Our results are comparable favourably with the result of above workers.

Initially, Sarmiento (1967) introduced functional cast bracing in treatment of fracture of shaft of long bones.

Nickel (1970), Connolly (1973), Mittal & Bonadio (1974), Brown et al (1975), Weiss (1976), Hardey et al (1977), Mooney et al (1977), Dhaon et al (1979), Hardey (1982) treated femoral shaft fractures either by skin or by tibial skeletal traction to obtain satisfactory position. They applied cast brace 3 to 6 weeks after injury when the fracture was no longer tender and swelling had subsided. During application of functional cast brace, they incorporated plastic quadrilateral brim in thigh section. They permitted assisted weight bearing till the patient

developed confidence and then permitted the full weight bearing. By this method, duration of hospitalization, knee stiffness, muscle wasting was minimized in comparison to conventional conservative treatment. But there were problems of angulation, non-union, malunion and shortening of more than 2 cms.

Cortwell (1978), Maini et al (1985) and Bhalla (1985) used thigh lacer instead of plaster cast bracing after initial skin or skeletal traction. The results in their series were more or less same as with cast bracing.

In 28 cases series of Bhalla (1985) treated by initial skeletal traction followed by thigh lacer, 6 cases had angulation more than 15 degree and shortening was seen in 6 patients. According to him thigh lacer provide stabilizing influence at the fracture site, allowing uninterrupted fracture healing and negligible movement at the fracture site. It gave gratifying result in the fracture of the middle and lower third femur, but not in fracture of upper third femur. In series of Maini (1985), treated by same method, 6 cases had a shortening more than 2 cm and 7 cases had angulation 11 to 20 degree.

The problem of angulation, malunion, non-union and shortening more than 2 cm and to reduce further hospitalization period, can be overcomed by the open reduction and rigid Kuntscher's intramedullary nailing.

Fig. 1 - Pre-operative skiagram of right thigh in male patient aged 30 years showing fracture at upper third of femur.

Fig. 2 - Early post-operative skiagram of the same patient with intramedullary nail in place.

The main problem with open reduction and intramedullary fixation is of infection. The problem of infection can be minimized by observing strict aseptic precaution, meticulus surgical technique and use of negative suction drainage.

Though inserting a snugly fitted nail and immediate ambulation is sound principle. It is not always practicable, especially for fractures in the lower third of shaft, there is always a fear of banding and breaking of nail which may leads to malunion or non-union. The thigh lacer offers additional advantage to provide external support and prevents angulation and rotational movement at fracture site, while the nail maintains alignment of fracture, thus permitting earlier ambulation and full weight bearing in the operated limb.

In majority of our patient, open reduction and Kuntscher's intramedullary nail was performed within 2 weeks of injury and the diameter of nail ranged from 10 to 11 mm. The thigh lacer was usually applied on 16 to 18th post-operative day after removal of stitches and ambulation permitted. The advantage of applying thigh lacer after 16 to 18 days is that by this time post-operative soft tissue reaction and swelling reduces to minimum. So that the thigh lacer do not get loosen and remains snugly fit on the thigh, it also allowed time for unhampered healing of tissues and recovery from surgical trauma.

After making ambulatory the patients were discharged from hospital at an earlier date. On an average, the patients were discharged on the same day after application of thigh lacer. The average post-operative stay was 17 days, while total duration of hospital stay in 78 percent cases was 3.7 weeks with the average 4.3 weeks. In Bhalla (1985) series, the average period of hospital stay was 4.95 weeks. It was 8.43 weeks in Cortwell's (1978) study. At the time of discharge from hospital, the patients were instructed to continue quadricep exercise and to bear weight as much as possible with the help of crutches and to attend office work and sedentary occupation while still in thigh lacer.

Thigh lacer forms semi-rigid compartment with the soft tissues of the thigh which act according to hydraulic theory of fluids. Visco-elasticity of soft tissue also stabilises the fragments before callus is formed. Charnley (1974) observed that following fracture of femoral shaft, the knee stiffness occurs more rapidly and takes longer to recover its full movements than probably any other joint. With the use of thigh lacer and an early ambulation regime, this problem is reduced to a considerable extent. The function of knee is far advanced by the time the fracture unites. Thigh lacer provides stabilization of the fracture and creates mechanical, chemical, electrical and thermal environment for un-interrupted osteogenesis.

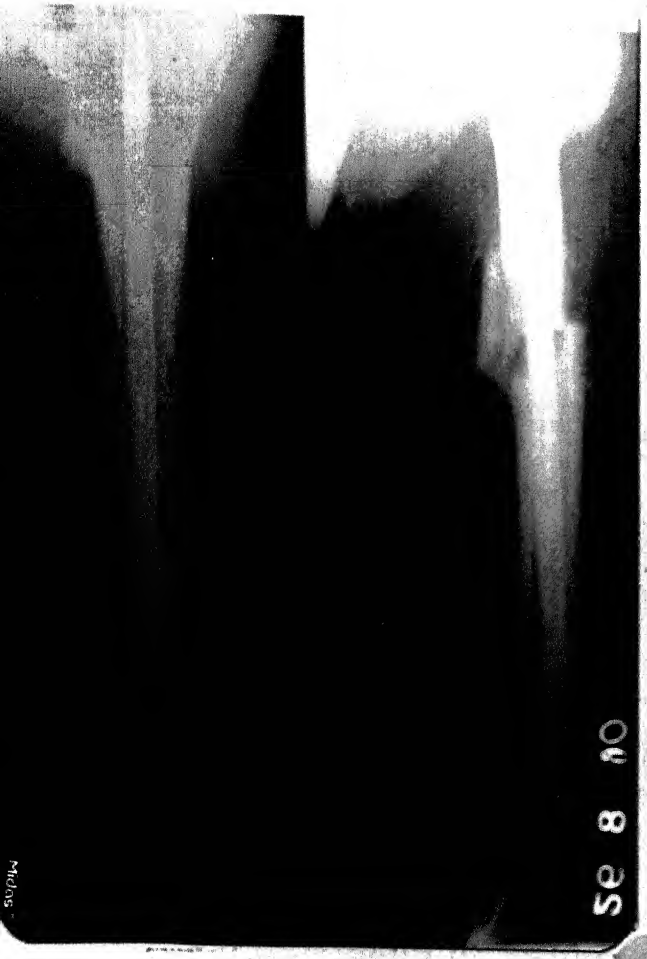

Fig. 1 - 37 years male patient skiagram 6 weeks after surgery (4 weeks after lacer) shows good amount of callus.

Fig. 2 - Good callus showing union after 14 weeks of surgery.

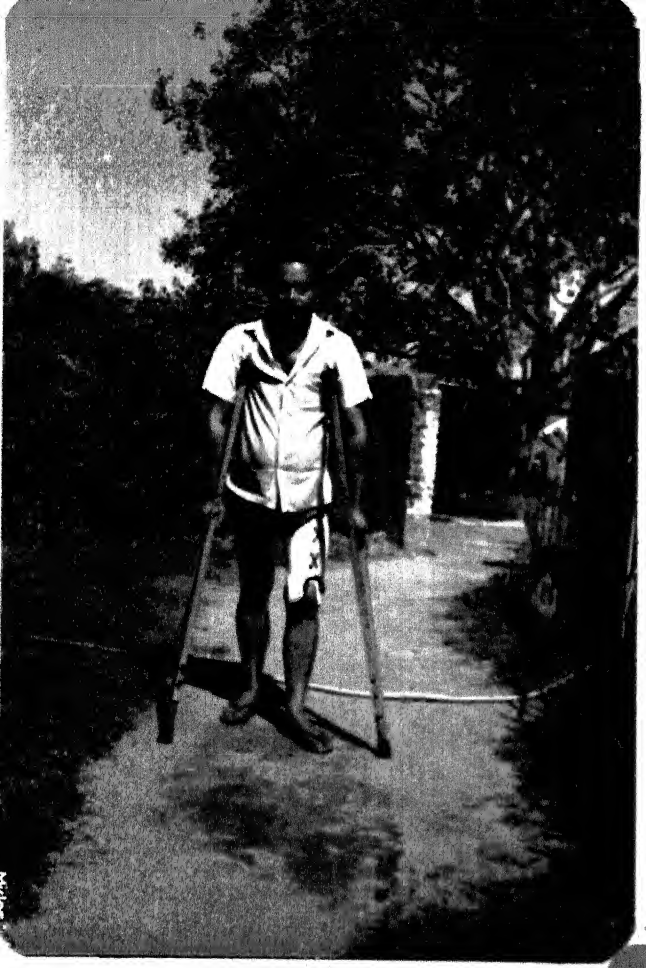

Fig. 3 - Same patient walking with the help of crutches.

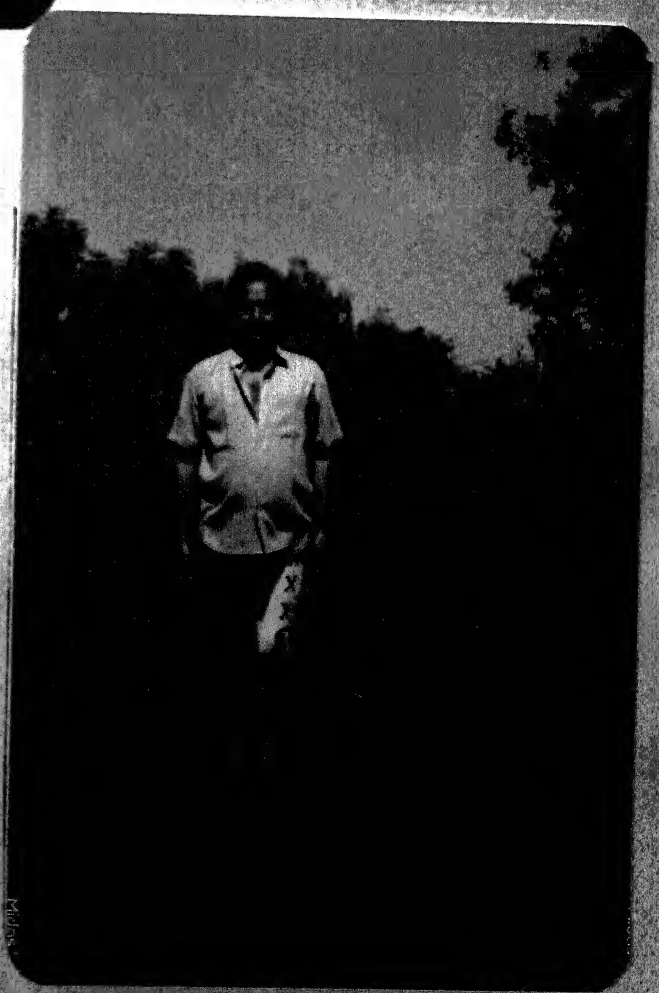

Fig. 4 - Same patient 6 weeks post-operative. Can stand unsupported with thigh lacer.

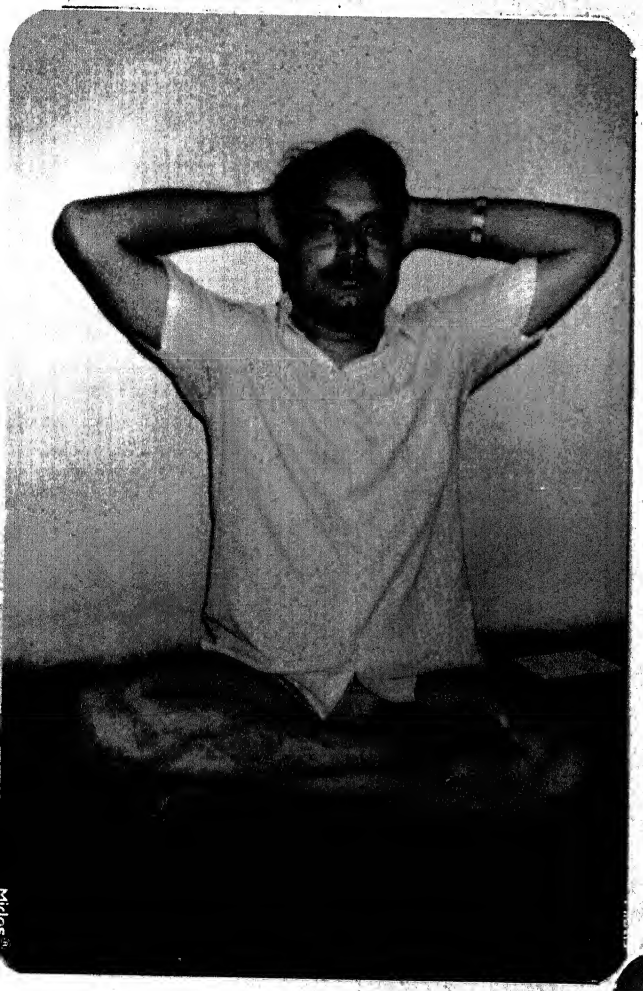

Fig. 5 - Same patient. 10 weeks post-operative sitting crossed legged without discomfort.

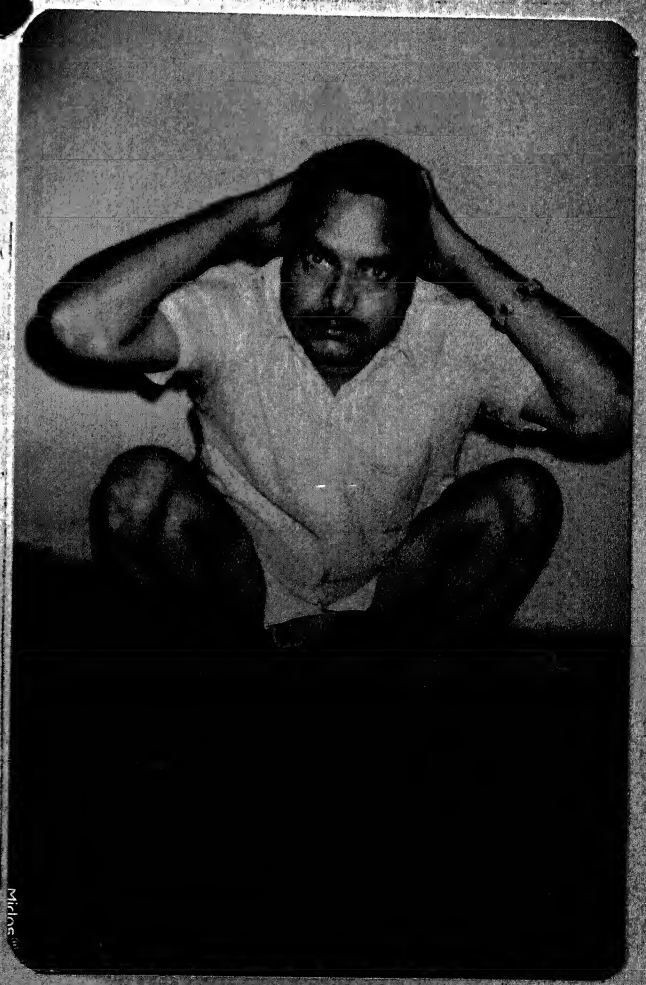

Fig. 6 - Same patient, 10 weeks post-operative effortless squatting. Showing full flexion at knee and hip.

Fig. 1 - Another 18 year female patient skiagram 6 weeks after surgery (4 week in brace) shows bridging callus.

Fig. 2 - Same patient Skiagram showing callus after 14 weeks of surgery.

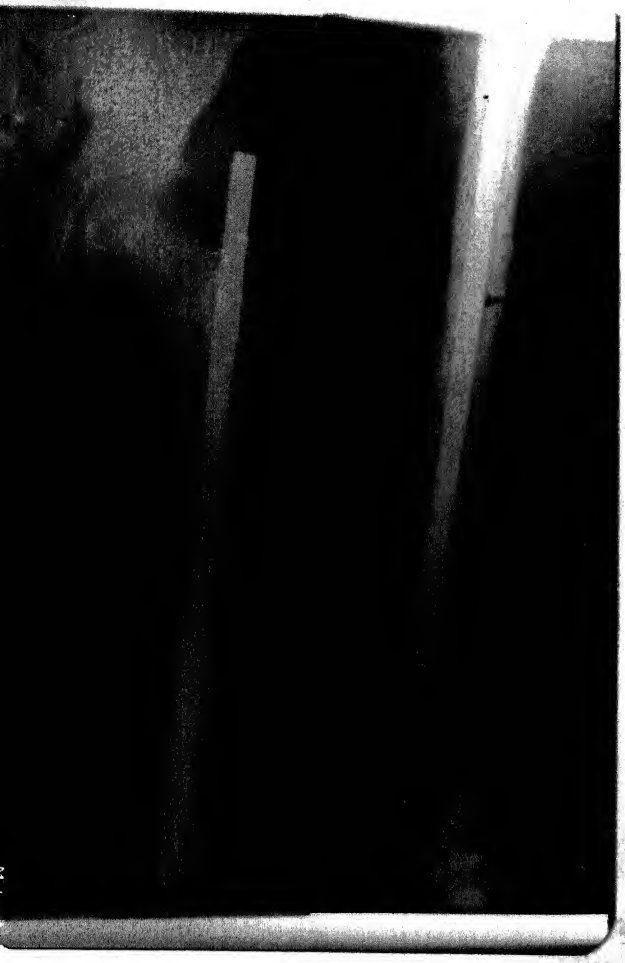

Fig. 1 - Another 19 years male patient. Skiagram showing callus 6 weeks after surgery.

Fig. 2 - Same patient Skiagram shows union after 14 weeks of surgery.

In few cases of present study there was excessive callus formation on concave side of the femoral shaft though there was obliteration of fracture line. Clinically there was no evidence of tenderness or complaint of pain while bearing full weight. It is attributed that the fixation by nail might not be rigid, which permitted the movements at fracture site, while patient bearing weight and doing knee bending exercise.

Thigh lacer not only provided excellent and good motion at the knee, but restored the functional ability of the patient at an early period, while wearing the lacer and as the union was still progressing, many patients could perform useful and productive activities. In this small series of 18 cases, 6 patients returned to their work in only 4 weeks after injury. There are certain distinct advantages of thigh lacer over functional cast bracing -

1. The lacer being made up of plastic, the total weight of the lacer has been reduced to less than 1/4th of weight of plaster cast brace.

2. The thigh lacer is less cumbersome than a cast brace. In fact, to walk about in a plaster brace is not easy and comfortable, especially in elderly patients.

3. The cost of the thigh lacer is economical and within the reach of an average patient. This compares very favourably with the cost of treatment by cast brace.

4. It can be occasionally taken off for local hygiene purpose.

5. Thigh lacer is adjustable and the desired fit can be maintained by the patient himself.

An average orthopaedic surgeon is affraid of starting early weight bearing following Kuntscher's intramedullary nailing, hence, an added protection in the form of thigh lacer appears to be a solution to start early weight bearing. There are certain distinct advantage of such a procedure which are evident from the analysis of the results of present series.

1. Better functional results :

The factors contributing to better functional results are -

(a) Early fracture union which appeared to be due to factors which were operative in fracture union following thigh lacer bracing such as biological compression, muscle activity, increased blood flow etc. It created the favourable physiological environment for osteogenesis.

(b) Better knee movements.

(c) Insignificant shortening.

The two patients who had knee movement less than 90 degree after 20 weeks of surgery having pre-operative knee stiffness due to prolonged immobilization.

2. Improved spectrum of indication :

The malunited and un-united fracture femoral shaft are contra-indicated for functional thigh lacer for obvious reasons. Internal fixation without or with bone grafting appears to have broadened the spectrum of indication of thigh lacer by amalgamating the advantage of internal fixation providing stability and thigh lacer providing early mobilisation and enhancement of fracture union.

3. Improved socio-economical factors :

Early mobilisation not only improves the psychological status of patient but also helps in early rehabilitation for at least light work. Thus overall socio-economic status of the patient improves.

The final functional results at the last follow-up improved to good in 89 percent cases and fair in 11 percent. There was no poor result. The excellent restoration of function and the rapidity of union are directly attributable to increased muscle activity that besides providing blood supply for callus formation, muscles themselves tended to act as live splints across the fracture site.

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Table - 1 : Comparison of various methods of treatment.

	Average period of hospital stay (in weeks)	Average period of clinical union (in weeks)	Average period of radiological union (in weeks)	Full weight-bearing (in weeks)	Return to work (in weeks)
K. nailing	6.3	11.3	24.6	12.9	13.1
K. nailing with cast brace	3.3	8.8	15	5.6	10
Traction with thigh lacer	7	10.3	14.41	9.1	10
K. nailing with thigh lacer	4.3	7	11.4	5.5	8

K. nailing	K. nailing with cast brace	Traction with thigh lacer	K. nailing with thigh lacer
ADVANTAGES :			
1. Accurate reduction and apposition of fracture. 2. Decreased hospital stay. 3. Fracture pain relieved early. 4. Complications of fracture is minimised.	In addition of K. nailing, adds followings - 1. Shortens hospitalization. 2. Promotes the healing of fracture. 3. Diminish the risk of knee stiffness. 4. Allows early return to work.	1. No risks of open reduction and fixation. 2. Retains unique advantages of brace which is light in weight, adjustable, washable, removable for personal hygiene.	Has distinct advantages over K. nail with cast bracing. 1. The weight of the thigh lacer is ¼th of cast brace. 2. Less cumbersome. 3. Economical. 4. It can be occasionally taken off for local hygiene purposes.
DISADVANTAGES : 1. There are risks of open reduction and internal fixation. 2. Non-union seen in 8 percent cases.	1. All the risks of open reduction. 2. Plaster cast brace may cause plater sores. It may get loose and can cause swelling over the knee joint.	1. Residual angulation at fracture site seen upto 20 degree. 2. Shortening of the limb more than 3 cm. also noticed.	1. Risks of open reduction. 2. Swelling of knee joint. 3. Superficial skin infection.

CONCLUSION

CONCLUSION

The present study of "Thigh lacer with Kuntscher's nailing in the management of fracture shaft femur" was conducted in the Department of Orthopaedics, M.L.B.Medical College and Associated Hospital, Jhansi. A total number of 18 cases were taken in the study. The results were evaluated and compared with results of other method of treatment of femoral shaft fracture.

The thigh lacer bracing after Kuntscher's intramedullary nailing for fracture shaft femur has certain outstanding advantage in addition to the advantages of intramedullary nailing.

1. Post Kuntscher's nailing thigh lacer avoids usual complication of fracture.

2. Plastic thigh lacer is economical.

3. It shortens the hospital stay.

4. By early ambulation restores the functional ability of patient at an early period.

5. It enhances the fracture union.

6. It produces the good range of knee movement before the fracture heal.

7. It improves socio-economical status by early return to their activities.

It can therefore be concluded that the method of Kuntscher's nailing followed by application of functional polythene thigh lacer is a simple and effective method in which the advantages of intramedullary fixation have been retained in addition to unique advantage of the lacer which is light in weight, adjustable, washable, removable for personal hygiene.

On the basis of present study, the early recovery of normal function and union with good results in majority of cases indicates that it is a good method to practice for treatment of fracture shaft femur in selected patients. Though this series is small and many more cases are required to be treated by this technique before the results could be statistically evaluated so that this regimen is universally accepted.

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